Claims

[c1] 1. A method for controlling an internal combustion engine, the engine being a multi-cylinder engine with a first group of cylinders coupled to an exhaust aftertreatment device and a second group of cylinders being decoupled from the exhaust aftertreatment device, the method comprising:
operating the first group of cylinders at a first operating condition; and
operating the second group of cylinders at a second operating condition, wherein the first operating condition generates a higher torque than said second operating condition and said second operating condition provides positive torque.

[c2] 2. The method of claim 1 wherein the engine has an injector disposed in an engine exhaust, said injector being capable of supplying reductant to the exhaust aftertreatment device, the method further comprising:
determining temperature in the OLE_LINK1exhaustOLE_LINK1 aftertreatment device when the first group of cylinders is operating at said first operating condition; and
commanding said injector to supply reductant when said temperature exceeds a threshold temperature.

[c3] 3. The method of claim 1 wherein the reductant is urea and the exhaust aftertreatment device is a lean NOx catalyst.

[c4] 4. The method of claim 1 wherein the engine has injectors disposed in engine cylinders, said injectors capable of supplying fuel to the exhaust aftertreatment device, the method further comprising:
determining temperature in the exhaust aftertreatment device when the first group of cylinders is operating at said first operating condition; and
commanding injectors disposed in said first group of cylinders to inject fuel during an expansion stroke of the engine when said temperature exceeds a threshold temperature.

[c5] 5. The method of claim 1, further comprising:
determining a driver demanded torque; and
determining said first and second operating conditions such that the engine

delivers substantially said driver demanded torque.

[c6] 6. The method of claim 1, further comprising:
determining a temperature in the exhaust aftertreatment device prior to performing said operating steps;
performing said operating steps when said temperature in the exhaust aftertreatment device is less than a threshold temperature.

[c7] 7. The method of claim 1 wherein the exhaust aftertreatment device is a lean NOx catalyst, the method further comprising: determining a quantity of reductant stored in said lean NOx catalyst wherein said operating steps are performed when said stored quantity is less than a predetermined quantity.

[c8] 8. The method of claim 7 wherein said stored quantity is based on an amount of reductant stored in said catalyst under predetermined conditions.

[c9] 9. The method of claim 8 wherein said predetermined conditions include a temperature in the lean NOx catalyst exceeding a threshold temperature.

[c10] 10. The method of claim 1 wherein the exhaust aftertreatment device is a diesel particulate filter and said first set of operating conditions causes a temperature in the exhaust aftertreatment device to exceed an ignition temperature of particulate matter collected in said particulate filter.

[c11] 11. A method for controlling torque in an internal combustion engine, the engine being a multi-cylinder engine with a first group of cylinders coupled to a first exhaust aftertreatment device and a second group of cylinders coupled to a second exhaust aftertreatment device, the engine having first and second injectors disposed in an engine exhaust, the injectors being capable of supplying reductant to the first and second aftertreatment devices, respectively, the method comprising:
operating the first group of cylinders at a first operating condition;
operating the second group of cylinders at a second operating condition, wherein said first operating condition generates a higher torque than said second operating condition; and
commanding the first injector to provide reductant to the first aftertreatment

device when temperature in the first aftertreatment device exceeds a threshold temperature.

[c12] 12. The method of claim 11, further comprising: determining temperature in first and second aftertreatment devices wherein said operating steps are performed when said determined temperature is less than said threshold temperature.

[c13] 13. The method of claim 12, further comprising: selecting said first operating condition so that the first aftertreatment device achieves said threshold temperature.

[c14] 14. The method of claim 12 wherein said threshold temperature is 350 degrees C.

[c15] 15. The method of claim 11, further comprising:
determining a driver demanded torque; and
selecting said second operating condition to provide said driver demanded torque by the first and second groups of cylinders.

[c16] 16. The method of claim 11, further comprising:
determining when a desired amount of reductant has been supplied to the first aftertreatment device; and
discontinuing said commanding to the first injector when said determination has been made.

[c17] 17. The method of claim 16, further comprising:
operating the first group of cylinders at said second operating condition;
operating the second group of cylinders at said first operating condition; and
commanding the second injector to provide reductant to the second aftertreatment device when temperature in the second aftertreatment device exceeds a threshold temperature.

[c18] 18. A system for controlling a multi-cylinder internal combustion engine, the engine having a first group of cylinders and a second group of cylinders wherein the first and second groups of cylinders are mutually exclusive, comprising:

a first exhaust manifold coupled to the first group of cylinders;
an exhaust aftertreatment device coupled to the exhaust manifold; and
an electronic control unit coupled to the engine, said electronic control unit operating the first group of cylinders at a first operating condition and operating the second group of cylinders at a second operating condition, wherein said first and second operating conditions provide positive and unequal torques.

[c19] 19. The method of claim 18, further comprising at least one additional exhaust manifold coupled to the second group of cylinders, wherein said exhaust manifold conducts exhaust gases from the cylinders to which it is coupled.

[c20] 20. The method of claim 18 wherein the groups of cylinders comprise at least one cylinder in each group.

[c21] 21. The system of claim 18, further comprising a reductant injector located upstream of said exhaust aftertreatment device, said injector being coupled to said electronic control unit wherein said electronic control unit commands said injector to inject reductant when a temperature in said first aftertreatment device exceeds a threshold temperature.

[c22] 22. The system of claim 18 wherein said engine is a diesel engine, said exhaust aftertreatment device is a particulate filter, and said first operating condition causes temperature in said particulate filter to exceed an ignition temperature of particulate matter collected in said particulate filter.

[c23] 23. The system of claim 22, further comprising: a lean NOx catalyst coupled to said exhaust manifold located upstream of said particulate filter.

[c24] 24. The system of claim 18 wherein said engine is a lean burn gasoline engine, said exhaust aftertreatment device is a lean NOx trap, and said first operating condition causes temperature in said lean NOx trap to exceed a deSOx temperature.

[c25] 25. The system of claim 24 wherein said deSOx temperature is a temperature at which SOx desorbs from the lean NOx trap and said deSOx temperature is

approximately 650 degrees C.

[c26] 26. The system of claim 18 wherein said engine is a lean burn gasoline engine, said exhaust aftertreatment device is a lean NOx trap, and said first operating conditions causes temperature in said lean NOx trap to exceed a lower operating temperature of said lean NOx trap.

[c27] 27. The system of claim 26 wherein said lower operating temperature is approximately 250 degrees C.

[c28] 28. The system of claim 18 wherein said engine is a lean burn gasoline engine, said exhaust aftertreatment device is a lean NOx trap, and said first operating conditions causes temperature in said lean NOx trap to be lower than an upper operating temperature of said lean NOx trap.

[c29] 29. The system of claim 28 wherein said maximum temperature is approximately 425 degrees C.

[c30] 30. A method for controlling a diesel engine, the engine being a multi-cylinder engine having a first group of cylinders coupled to a first lean NOx catalyst and a second group of cylinders coupled to a second lean NOx catalyst wherein said first and second groups of cylinders are mutually exclusive , the method comprising:
discontinuing fuel delivery to the first group of cylinders;
operating the second group of cylinders at an operating condition providing a driver demanded torque with the fuel delivery to the first group of cylinders being discontinued; and
supplying reductant to the first lean NOx catalyst the second group of cylinders being at an operating condition providing a driver demanded torque and with the fuel delivery to the first group of cylinders being discontinued.

[c31] 31. The method of claim 30, further comprising:
discontinuing supplying reductant when it is determined that the lean NOx catalyst has substantially reached storage capacity; and
resuming fuel delivery to the first group of cylinders.

[c32] 32. A method for controlling a diesel engine, the engine being a multi-cylinder engine having a first group of cylinders coupled to a lean NOx catalyst, a second group of cylinders not coupled to the lean NOx catalyst, and a reductant injector disposed in an engine exhaust coupled to the first group of cylinders for providing reductant to the lean NOx catalyst, the method comprising:
determining a driver demanded torque;
operating said first and second groups of cylinders according to a first set of operating conditions when said driver demanded torque is greater than a predetermined torque; and
operating said first and second group of cylinders according to a second set of operating conditions when said driver demanded torque is less than said predetermined torque wherein said first and second sets of operating conditions are such that a torque provided by said first group of cylinders is different than a torque provided by said second group of cylinders.

[c33] 33. The method of claim 32 wherein said first set of operating conditions, further comprises:
operating the first group of cylinders at a first operating point;
operating the second group of cylinders at a second operating point, wherein said first operating point generates a higher torque than said second operating point and said second operating point provides positive torque; and
commanding said injector to provide reductant to the lean NOx catalyst when a temperature within the lean NOx catalyst exceeds a predetermined temperature.

[c34] 34. The method of claim 32 wherein said second set of operating conditions further comprises:
discontinuing fuel delivery to the first group of cylinders;
operating the second group of cylinders at an operating point which causes the engine to provide said operator demanded torque with fuel delivery to the first group of cylinders being discontinued; and
commanding said injector to provide reductant to the lean NOx catalyst while operating the second group of cylinders at an operating point which causes the engine to provide said operator demanded torque with fuel delivery to the first group of cylinders being discontinued.

[c35] 35. The method of claim 32 wherein said predetermined torque is based on at least one of: ambient temperature, engine coolant temperature, engine speed, age of the lean NOx catalyst, output from an exhaust gas composition sensor disposed in the engine exhaust, a throttle valve position, an EGR valve position, and timing of valves disposed in engine cylinders.

[c36] 36. A method for controlling temperature of an internal combustion engine exhaust gas aftertreatment device, such method comprising:
estimating temperature in the aftertreatment device; and
operating a first portion of a plurality of engine cylinders at a first torque output and operating a second portion of said plurality of engine cylinders at a second torque output when said temperature is not within a desired temperature range wherein the overall torque output of the engine is substantially an operator demanded torque and said first portion of cylinders is coupled to the aftertreatment device.

[c37] 37. The method of claim 36 wherein said second portion of engine cylinders is decoupled from the aftertreatment device.

[c38] 38. The method of claim 36 wherein said temperature estimation is based on an output from a temperature sensor located proximate to said aftertreatment device.

[c39] 39. The method of claim 36 wherein said temperature estimation is based on a model of aftertreatment.

[c40] 40. The method of claim 36 wherein said operator demanded torque is determined based on a position of an accelerator pedal.

[c41] 41. The method of claim 36 wherein said exhaust aftertreatment device is a particulate filter, the desired temperature range is a temperature greater than an ignition temperature of particulate matter collected in said particulate filter, and said first torque output is greater than a second torque output.

[c42] 42. The method of claim 36 wherein said exhaust aftertreatment device is a lean NOx catalyst, the desired temperature range is greater than an activation

temperature of said lean NOx catalyst, and said first torque output is greater than a second torque output.

[c43] 43. The method of claim 36 wherein said exhaust aftertreatment device is a lean NOx trap, the desired temperature range for purging NOx from said lean NOx trap is between 250 and 425 degrees C, the first torque output is greater than the second torque output when the temperature is less than 250 degrees C and the first torque output is less than the second torque output when the temperature is greater than 425 degrees C.

[c44] 44. The method of claim 36 wherein said exhaust aftertreatment device is a lean NOx trap, the desired temperature range for causing SOx to desorb from said lean NOx catalyst is a temperature greater than 650 degrees C, the first torque output is greater than the second torque output.